Using Ontologies in Drug Prescription: The SemMed Approach

Alejandro Rodríguez-González, Universidad Carlos III de Madrid, Spain
Ángel García-Crespo, Universidad Carlos III de Madrid, Spain
Ricardo Colomo-Palacios, Universidad Carlos III de Madrid, Spain
Juan Miguel Gómez-Berbís, Universidad Carlos III de Madrid, Spain
Enrique Jiménez-Domingo, Universidad Carlos III de Madrid, Spain

ABSTRACT

Medical prescription has been touted as following an accurate approach to addressing particular health problems. However, the importance of the process might demand considering a formal knowledge-driven procedure to ensure its correctness which can be achieved through Medical Decision Support Systems (MDSS). Semantic Technologies have emerged as a potential silver bullet to become the backbone of those particular Information Systems since it provides seamless integration and an underlying logical formalism. This paper sheds light into using ontologies for drug prescription through the SemMed model, architecture and proof-of-concept implementation, being able to face challenges in these areas and solve day-to-day problems of health professionals in terms of drug prescription.

Keywords: Differential Diagnosis, Drug Prescription, Medical Decision Support Systems (MDSS), Ontologies, Semantic Web

INTRODUCTION

Medication prescription plays a central role in healthcare. Nevertheless, medication is not always prescribed effectively (Martens et al., 2007). Apart from higher costs, a number of different risks concerning patient health have been raised. Medication-oriented errors are usually the result of failures during the medication process (Eslami, de Keizer, & Abu-Hanna, 2008). Errors can occur in any step of this process: taking history, ordering, pharmacy management, administration management or surveillance (Kilbridge & Classen, 2001). Prescription errors are often associated with poor health information (Bates et al., 2001). In order to reduce the risks caused by human factors, alert functions are set up in the prescription systems to remind doctors to check the related information (Lai et al., 2007). Therefore, taking into account that Information Technology enables us to do

DOI: 10.4018/ijkbo.2011100101
things in a better way (Fazlollahtabar, 2008),
computer-based reminders proved to be effecti
ve in influencing doctor behavior in medication
management (Bennett & Glasziou, 2003). On
the other hand, the inability of the average phy
sician to memorize the ever increasing number
drugs, treatment regiments and side effects
can be also a source of prescription problems
(Dean et al., 2002). In this scenario, computer-
based Decision Support Systems (DSS) provide
advice to care professionals based on guidelines
can solve some of the problems related to drug
prescription, among others (e.g., Goud, Hasman,
& Peek, 2008; Garg et al., 2005). The develop-
ment of Decision Support Systems (DSS, for short)
is increasingly important in primary care
for prescribing, performance measures, cost
control and quality of care (Ruland & Bakken,
2002). Thus, DSS systems related to medicine
are gaining importance in the literature (e.g.,
German, Leibowitz, & Shahar, 2009; Jerbi &
Kamoun, 2009; Vich, Gomez, & Carnero, 2009;
Zhuang et al., 2009), to cite just the most recent
and relevant ones.

Semantic Technologies have been pointed
out as the future of Web (Benjamins et al., 2008)
and a new way to support knowledge (Vossen et
al., 2007; Fensel & Musen, 2001) in a wide range
domains (Lytras & Garcia, 2008), including
medicine. Semantic Technologies, based on
ontologies (Fensel, 2002), provide a common
framework that enables for data integration,
sharing and reuse from multiple sources.

Given the importance of drug prescription
and the crucial role DSS is playing in medi
cal praxis, the goal of this paper is to present
SemMed, a system based on Semantic Tech
ologies that is in the proof-of-concept phase,
to develop a system with the capability to assist
healthcare professionals regarding the possible
medication or drug to prescribe, according to
following fundamental selection criteria. Se
mantic Technologies provide a higher amount
of possibilities when managing and operating
with specific information in the sense that this
technology offer many advantages. These forth
comings gain more importance in this domain
due to the seriousness that takes the Medicine
scope. For all these reasons, SemMed uses
ontologies where all the necessary information
is stored. This information includes data
such as those regarding to drugs and illnesses.
With this and the data pertaining to the patient
in subjects like allergies, medicines that he is
already taking and the diagnosed illness, it is
possible to run a knowledge extraction process
that allows the user to obtaining the particularly
needed information. One of the strong points
of SemMed that sets the difference from other
projects with similar aims is that the use of
ontologies as an information storing system
provides implicitly the possibility, amongst
others, of making direct inference from this
ontology. Thanks to that, the possibility of
making logical operations produce an optimal
and adequate recovery of information, provid
ing the necessary knowledge and allowing
the specialist to whom is focused the DSS for
giving a more appropriate and accurate diag
nostic, reducing or even removing the human
errors that could be derived from these kind of
tasks. Moreover, the problems derived from the
queries to a database are solved because of the
fact that the databases could not identify and
manage semantic information. Consequently,
it is impossible to establish in a proper way
the existing relationships between each of the
variables involved in the drug recommendation
system. In addition, a formal specification of
the domain is created which contains all the
necessary knowledge and could be use by other
systems, avoiding the limits in the scope, allow
ing the appliance to systems that do not have
to deal with diagnosis necessarily.

The remainder of the paper is organized
as follows. First we outline relevant literature
in the area. The architecture for the SemMed
approach is presented along with the description
of the ontology used and the rules deployed.
Conclusions and future work are discussed.

LITERATURE REVIEW

In this section, authors briefly review the related
concepts about Semantic Technologies, the
Managing Knowledge: The Critical Role of Culture and Ownership as a Mediator of Systems
www.igi-global.com/article/managing-knowledge/83610?camid=4v1a

Knowledge Transfer and Team Performance in Distributed Organizations
www.igi-global.com/article/knowledge-transfer-and-team-performance-in-distributed-organizations/125585?camid=4v1a